REMARKS

Claim 10 has been amended to eliminate reference to an "element," which had been deleted in a prior office action.

103 Rejection: Brandy/Kuszyk

The Examiner has rejected claims 10-16 and 19-21 as obvious in light of US 6,380,114 to Brandy and US 5,328,878 to Kuszyk. A prima facie case of obviousness exists only when the Examiner provides:

1. one or more references;
2. that were available to the inventor;
3. that teach;
4. a suggestion to combine or modify the references;
5. the combination or modification of which would appear sufficient to have made the claimed invention obvious to one of ordinary skill in the art.

Applicants do not believe either reference teaches all elements of the present invention, specifically a pouring channel coated with an insulating coating that forms a gas impermeable layer on contact with liquid metal. The cited references lack at least (1) an insulating coating comprising microspheres on the inner surface of a pouring shroud and (2) a coating that contacts molten metal and vitrifies to form a gas impermeable layer.

Brandy teaches an insulating coating for the exterior of a refractory article, such as a pouring tube or stopper rod. The coating improves preheating efficiency. See col. 1, line 19. Notably, the coating is deposited on the outside of the article. See col. 5, line 21. Attached is an affidavit by Eric Hanse. Mr. Hanse explains that prior art used insulating coatings on the exterior of a refractory article, specifically to improve preheating. Such exterior coatings do not vitrify. See paragraph 16.

The Examiner believes the combination of Brandy and Kuszyk obviates the claims. The Examiner admits Brandy does not teach the formation of a gas-impermeable layer at the coating/molten metal interface, but argues that Kuszyk teaches:

> the use of forming a gas impermeable layer with liquid metal by infiltrating molten metal into refractory material (microsphere filler) and making protective interpenetrated gas impermeable (aluminum nitride matrix ceramic composite) layer for the purpose of preventing the attack of thermal shock when the composite bodies such as pouring shrouds are used in casting environments.

Applicants believe the Examiner has misunderstood the teaching of Kuszyk. Kuszyk does not teach a coating.

Kuszyk teaches a refractory oxide aggregate within an aluminum nitride matrix. A filler material may include microspheres. See claim 10. The aluminum nitride matrix is formed during firing of a composite comprising aluminum metal in a nitrogen atmosphere. See, e.g., col. 12, lines 61-66. Firing occurs above the melting point of aluminum metal but below the melting point of aluminum nitride. See col. 5, lines 4-10. Because a nitrogen atmosphere is required, firing necessarily occurs before and not during casting. During firing, essentially all aluminum metal reacts with nitrogen to form aluminum nitride. This is fortunate because suddenly exposing aluminum metal to casting temperatures in an oxygen-containing atmosphere, i.e., air, would likely be explosive. Aluminum cannot form a gas impermeable layer on contact with molten metal because the aluminum is no longer present.

The present invention includes a pouring tube having an interior bore coated with an insulating coating comprising microspheres. The coating reduces thermal shock and the need for preheating. Additionally and surprisingly, the coating vitrifies to form a gas

impervious layer. Neither Brandy nor Kuszyk teach a coating on an interior bore of a pouring tube or a coating that contacts molten metal and vitrifies to form a gas impervious layer. Kuszyk does not even teach a coating. The references lack any teaching related to a vitrifying coating in a pouring channel of a pouring shroud.

By way of further argument, Mr. Hanse distinguishes (a) a pouring channel having a vitrifying layer from (b) prior art pouring channel's with an oxide layer. A thin oxide layer may form when a carbon-bonded or aluminum nitride-bonded article is heated in the presence of oxygen. The oxide layer initially functions as a thermal barrier but the friable oxide layer quickly washes away, thereby decreasing wall thickness and mechanical strength of the shroud. See paragraph 13. At no time does a vitrified layer form.

In contrast, the present invention claims an insulating layer on the interior surface of a pouring tube that forms a vitrified layer on contact with molten metal. The insulating layer can reduce or eliminate the need for preheating by reducing thermal shock to the pouring tube. Wall thickness and mechanical strength of the shroud is unaffected. Additionally and surprisingly, Applicants discovered that the insulating layer vitrifies to form a gas impervious layer. See paragraphs 14 and 15.

The references, even in combination, lack motivation to place an insulating coating on an inner surface, fail to teach an insulating coating on an inner surface comprising microspheres, and make no reference to a vitrified, gas impermeable layer. The cited references lack several elements of the claims. Claims 10-16 and 19-21 are not obvious and are allowable subject matter. Applicants request cancellation of this basis for rejection.

103 Rejection: Brandy/Kuszyk/Juma

The Examiner has rejected claim 17 as obvious in light of Brandy, Kuszyk and US 5,840,433 to Juma. Claim 17 is allowable as a dependent claim of allowable claim 17.

Applicants submit pending claims 10-17 and 19-21 are allowable and the application is in condition for allowance. Early and favorable action is earnestly solicited.

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Respectfully submitted,

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